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THE INFLUENCE OF NOVELTY EFFECT UPON TEACHING MACHINE LEARNING.

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THE EXPERIMENT PROPOSED IN THIS STUDY WAS TO SUPPLY EVIDENCE RELEVANT TO THE QUESTION OF HOW MUCH INFLUENCE, IF ANY, A POSTULATED NOVELTY EFFECT WOULD HAVE UPON THE EFFECTIVENESS OF LEARNING IN A SELF-INSTRUCTIONAL SITUATION. THE HYPOTHESIS WAS--THERE WILL BE NO SIGNIFICANT DIFFERENCES IN ACHIEVEMENT OF TWO COMPARABLE GROUPS OF ELEMENTARY PUPILS IN A SELF-INSTRUCTIONAL PROGRAM WHEN ONE OF THE GROUPS USES TEACHING MACHINES FOR THE FIRST TIME AND THE OTHER GROUP HAS HAD EXTENDED PREVIOUS EXPERIENCE WITH THE MACHINES. ONE GROUP OF 11 SIXTH-GRADERS HAD A FALL SEMESTERS' EXPERIENCE WITH A TEACHING MACHINE APPROACH TO LEARNING FUNDAMENTALS OF ALGEBRA. DURING THIS PERIOD A SECOND GROUP OF 12 STUDENTS HAD NO CONTACT WITH THE MACHINES, BUT WAS INTRODUCED TO COMPARABLE ALGEBRA TOPICS BY THE REGULAR CLASSROOM TEACHER. DURING THE SPRING SEMESTER BOTH GROUPS DEVOTED THREE 30-MINUTE SESSIONS PER WEEK TO AN ELEMENTARY GEOMETRY PROGRAM, PRESENTED BY TEACHING MACHINES. PERFORMANCE OF THE TWO GROUPS ON MEASURES OF GEOMETRY KNOWLEDGE ADMINISTERED ON TWO OCCASIONS DURING THE SEMESTER SERVED TO TEST THE HYPOTHESIS. THE HYPOTHESIS WAS ACCEPTED IN THAT NO DIFFERENCES BETWEEN THE TWO GROUPS WERE DISCOVERED. (JC)

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PROBLEM*

"How much of the apparent success of teaching machine learning is merely due to the 'novelty effect' produced by the devices?" This question mirrors a concern of educational researchers as well as those school administrators who might consider possible acquisition of self-instruction equipment. To the researcher, the question dictates caution in the interpretation of what generally have been rather encouraging experiments testing the effectiveness of programmed learning approaches. To the school administrator, the question may engender enough skepticism to discourage the use of self-instruction devices, even on a trial basis.

Particularly in the case of teaching machines, in contrast with programmed books, one might suspect that the very uniqueness of the devices themselves could produce heightened student motivation and hence superior learning. While programmed texts are in many respects more comparable to conventional instructional materials, even the effectiveness of these materials may be underestimated because of their novel features.

Only Porter (1958) reports research bearing on this important question. He offers evidence that after a five month period of using teaching machines there was no indication of lessening student motivation.

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More recently, both Keisler (1959) and Carr (1960) have warned against the possible influence of novelty effect, an effect which might lose its value over an extended period of time. In commenting on the Porter research, Carr urges that ". . . more research of this sort (dealing with novelty effect) is necessary before we can be sure that confirmation can be relied upon to maintain its reinforcing property for very long periods of time."

PURPOSE

If the foregoing observations are accurate, it becomes apparent that attention should be given to the possible influence of novelty effect upon learning acquired through approaches featuring auto-instructional devices. The experiment to be described was explicitly designed to explore this question.

The experiment proposed to supply evidence relevant to the question of how much influence, if any, a postulated novelty effect would have upon the effectiveness of learning in a self-instructional situation. Specifically, the null hypothesis tested was the following: There will be no significant difference in the achievement of two comparable groups of elementary pupils in a self-instruction learning situation when one of the groups uses teaching machines for the first time and the other group has had extended previous experience with the machines.

METHOD

Essentially, the research design of the project involved comparisons of the performances of two student groups on an identical self-instruction learning task. One of the groups was using teaching machines for the first time, while the other group had been previously exposed to teaching machine learning for an academic semester. It was postulated that a novelty effect which might be conducive to better learning was present to a greater extent in the case of the students who were learning via machines for the first time.

In greater detail, one group of sixth grade elementary school pupils (hereafter referred to as the low novelty effect group) had a semester's experience with a teaching machine approach to learning the fundamentals of algebra. During the 1961-62 fall semester, each student devoted three 30-minute periods a week to an algebra program[1] presented by a Foringer #2002 teaching machine. The machine instruction took place in a vacant classroom, adjacent to the regular classroom, under the supervision of a student assistant. During this period the second group (hereafter referred to as the high novelty effect group) had no contact with the teaching machines, but was introduced to comparable algebra topics by the regular classroom teacher.

During the spring semester both groups devoted three 30-minute periods per week to an elementary geometry program,[2] also presented by the Foringer devices. Students in the high and low novelty effect groups were randomly assigned in equal proportions to four teaching machine work

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[1] Program used was the Fundamentals of Algebra material distributed by The Teaching Materials Corporation.

[2] Geometry program used was the Plane Geometry material distributed by the TEMAC Division of Encyclopaedia Britannica Films, Inc.

groups who used the six available teaching machines at different times. It was assumed that the greater familiarity of the low novelty effect group with the machines and general procedures associated with self-instruction would tend to mitigate that interest in the geometry materials which might be attributable to the newness of the instructional approach itself. Whereas with the high novelty effect group, using the teaching machines for the first time, the uniqueness and hence inherently interesting nature of the situation would be apparent.

Performance of the two groups on measures of geometry knowledge administered on two occasions during the spring semester served to test the null hypothesis. The algebra learning experience was used only to influence the perception of low novelty effect group by reducing the uniqueness of the learning situation.

Subjects in the two groups were drawn from a single sixth grade class in the Frederic Burk School, the San Francisco State College elementary demonstration school. The two groups were matched at the beginning of the school year according to pupils' scores on the California Test of Mental Maturity and SRA Arithmetic Achievement Test. Recent scores on both these measures were available for all students from school records. Twelve students formed the high novelty effect group, while eleven students were included in the low novelty effect group.[3]

The criterion measures by which the null hypothesis was tested were students' difference or "gain" scores between an initial geometry test, administered at the beginning of the spring semester, and two other

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[3] One of the 12 pupils originally included in the low novelty effect group transferred from the school after the experiment had been commenced.

geometry tests administered later during the spring semester. All items for these tests were drawn from the suggested tests accompanying the TEMAC programmed geometry learning materials.

The first test, a 40-item instrument, was administered to all subjects during the first week of February. This test, which covered frames 1-200 of the self-instruction program, was used to assess the knowledge of geometry that students possessed prior to their use of the machine-presented geometry programs. While difference scores between a pupil's performance on this 40-item test and subsequent tests were to be employed, it should be noted that the performance of the two groups on the February test was quite similar. For the high novelty effect group the mean number right was 6.75 and the standard deviation was 3.54. For the low novelty effect group the mean number right was 7.00 and the standard deviation was 2.28.

All students initiated their work on the geometry programs on February 13. On March 6 a 63-item geometry test covering frames 1-600 of the program was administered to both groups. At that time nine half-hour work sessions had been made available to each student so that, barring absence, each student had devoted 270 minutes to the machine-presented geometry materials. Difference scores of the two groups were contrasted by the nonparametric Mann-Whitney U test. Differences between the groups with respect to (1) number of frames completed and (2) time devoted to the programs were also checked.

In the original design of the experiment the March 6 test, administered relatively soon after students had initiated their work on the geometry programs, was considered important because a possible influence attributable to novelty effect might be present during the early stages of the two groups' use of the geometry programs. It was considered possible that such an early novelty effect influence might be dissipated as the experiment wore on,

hence the early testing. If a significant performance difference favoring the high novelty effect group had been observed during the March 6 testing, it was planned to administer periodic achievement tests to both groups after every nine or ten teaching machine work sessions in order to note the continued presence or disappearance of this performance differential.

As will be seen in the results section of this report, periodic testing was not dictated by the results of the analysis of the March 6 test data, hence only a final criterion examination was administered at the close of the spring semester on June 4. This terminal examination consisted of 116 items with 143 possible points for a perfect paper. The test covered frames 1-1,850 in the geometry program. Difference scores of the two groups were contrasted by the Mann-Whitney U Test. Differences between the two groups were also noted with respect to number of frames completed as well as number of sessions devoted to the teaching machines.

Also on June 4 a questionnaire designed to assess student attitudes toward the teaching machine mode of instruction was administered to both groups. Differences between questionnaire responses of the two groups were tested for statistical significance by the nonparametric Fisher exact probability test.

RESULTS

Before turning to the performance of the two groups on the criterion tests, it will be useful to examine the comparability of the students on the measures of intelligence and arithmetic achievement used to match the two groups. In Table I the means and standard deviations for both groups on these two measures are presented.

Table I

Performance of the High Novelty Effect Group and Low Novelty Effect Group on the California Test of Mental Maturity and the SRA Arithmetic Achievement Examination.

Group	n	California Test of Mental Maturity $\bar{X}$	s	SRA Arithmetic Achievement $\bar{X}$	s
High Novelty Effect	12	68.58	7.95	57.33	12.41
Low Novelty Effect	11	68.64	7.20	57.18	11.27

Analysis of March 6 results. Prior to analyzing test results of the two groups after the March 6 testing, differences were appraised between the groups regarding time expended on the teaching machines as well as number of frames completed.

Because of the possibility of student absences resulting in less machine time for one group, the minutes devoted by each student to the programmed materials were recorded. Time devoted to the programmed learning by each group was quite similar, with mean minutes of machine time for the high novelty effect group equalling 242.5, and for the low novelty effect group 233.0. The number of frames completed by each group was almost identical. ($\bar{X}_{hne}$= 256.16; $\bar{X}_{lne}$= 261.40).

The mean performances of the two groups' "gain" scores were practically equivalent. The mean of the high novelty effect group was 21.00 while the mean of the low novelty effect group[4] was 21.80. The difference between the two groups, as indicated by a Mann-Whitney test was not statistically significant ($U = 55.5$)[5].

Analysis of June 4 results. Since the March 6 test revealed no superiority for the high novelty effect group, the terminal examination administered on June 4 was the only other criterion measure employed.

The analysis pattern was similar to that employed for March 6 data. First, differences between the two groups with respect to time devoted to the program and number of frames completed were inspected. As in the March analysis, the differences between the groups on both of these scores were trivial. The mean number of half-hour work sessions with the machines by the high novelty effect group was 33.92. For the low novelty effect group the mean number of sessions with the machines was 32.18. The mean number of frames completed by the high novelty effect group was 998.8, while for the low novelty effect the mean number of frames completed was 1,026.5.

The mean performance of the two groups in terms of "gain" scores was quite similar. The mean of the high novelty effect group was 41.42 and the mean of the low novelty effect group was 39.73. The difference between

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[4] Only ten of the low novelty effect students took the March 6 test since one student was absent on that occasion and for several days thereafter.

[5] This result was confirmed by the more powerful analysis of covariance technique in which CTMM scores and SRA Arithmetic Achievement scores served as control measures ($F_{1,18} = .098$).

the two groups, when analyzed by a Mann-Whitney test, was not statistically significant ($\underline{U} = 62.5$).[6]

On the basis of data analyses for both criterion tests, then, there were no significant differences between the two groups. Hence, the null hypothesis under investigation was considered tenable.

Results of the three geometry quizzes administered in February, March, and June are reported for the high novelty effect and low novelty effect groups in Table II.

Table II

Performance of Twelve High Novelty Effect Pupils and Eleven* Low Novelty Effect Pupils on Three Geometry Examinations.

	February Test 40 items		March Test 63 items		February - March "Gain"		June Test 116 items		February - June "Gain"	
Group	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s
High Novelty Effect	6.75	3.54	27.75	10.37	21.00	9.04	48.17	23.25	41.42	21.78
Low Novelty Effect	7.00	2.28	28.80	9.01	21.80	8.86	45.82	19.26	38.82	18.60

*One low novelty effect student was absent during the March testing.

Analysis of questionnaire results. Both groups completed a questionnaire at the close of the experiment which solicited student opinions regarding the teaching machine mode of instruction. In an effort to induce greater validity in the responses of the students, the questionnaire directions

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[6] This result was confirmed by the more powerful analysis of covariance technique in which CTMM scores and SRA Arithmetic Achievement scores served as control measures ($F_{1,19} = .131$).

implied that responses to the instrument would be forwarded to each pupil's new junior high school in the fall, where they might play a role in determining whether the student would use teaching machines in the future. Students were asked (1) Whether they liked to use teaching machines; (2) Whether they would prefer to study mathematics by teaching machines next year; (3) Whether they felt the teaching machines were used too often in class; (4) Whether they would have gotten more or less out of the course if the teaching machines had not been used; (5) Whether they became tired of using the machines as the school year progressed; and (6) Whether they would choose to use teaching machines for part of their study in their next school.

Responses of the two groups to all of these questions were almost identical. The lack of a statistically significant difference was verified by computing six Fisher exact probability tests. A copy of the questionnaire items, along with the responses of both experimental groups, is included in the Appendix.

DISCUSSION

Consideration of the results of this experiment leads to the conclusion that insofar as novelty effect was produced (for both groups) and diminished (for the low novelty effect group) by the design of the study, it was not a factor of importance in the self-instruction learning task. The null hypothesis was accepted on the basis of the criterion test administered in March, a few weeks after the high novelty effect group started to use the teaching machines. The null hypothesis was also accepted on the basis of the criterion test administered four months after the high novelty effect group initiated their teaching machine work.

It should be pointed out that the "gain" scores used to test the null hypothesis do not actually represent advancement on the same test, for on each testing occasion a geometry examination was devised which would cover only that portion of the program which might reasonably have been encountered by the students in the experiment. Thus, a longer test was used for the March testing than had been used in February, and a still longer test was used in June.

A comment should also be made regarding the reason for the selection of algebra and geometry materials for use with sixth grade pupils. These programs were chosen since it was assumed that pupils' knowledge of both subject matter areas would be relatively minimal.[7] The geometry program was selected to follow the algebra program used by the low novelty effect group since, although it contains concepts and skills which are different from those encountered in algebra, it falls in the same overall content field of mathematics. It was believed that if a program from a totally different subject field (such as a foreign language) had been chosen for the second semester, the low novelty effect group might have viewed the new learning materials as being sufficiently novel to cancel out the novelty effect differential the study was designed to produce.

It should also be noted that since the experiment was conducted in a college demonstration school where college student-observers in classrooms are fairly common, the possible influence of "Hawthorne" effect was probably diminished. On the other hand, this same situation might make it more difficult to generate a novelty effect for sixth grade youngsters who have experienced several years of adult observation.

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[7] The somewhat negative attitude toward teaching machine instruction reflected in the questionnaire responses of some students was undoubtedly due to the difficulty level of the programmed materials which were developed for use at the high school level.

Finally, it must be emphasized that while the results of this study will be viewed with favor by those proponents of programmed instruction who believe the merits of this approach to be based on sound learning principles rather than novelty effect, the results of a single study are far from conclusive. We must await results of further experimentation before the novelty effect variable can be excluded from our considerations in programmed learning research.

SUMMARY

The performance of two groups of sixth grade youngsters on an identical teaching machine learning task was contrasted in this experiment. One group of pupils had been exposed to a teaching machine learning task for a semester, the other group used teaching machines for the first time. It was postulated that "novelty effect" would be present to a greater degree in the case of those youngsters in the latter group. On the basis of two criterion tests, one administered early in the experiment and one administered several months later, no difference between the two groups was discovered. Novelty effect was concluded to be of no importance in the learning situation.

APPENDIX

TEACHING MACHINE QUESTIONNAIRE
(With Student Responses Included)

Next year you will be in a new grade and a new school. As you know, your records for this school are sent to your new school to guide your new teachers. Your response to this questionnaire may also be transmitted to the new school, thereby determining if you will use teaching machines in the future. Therefore, be very truthful in how you answer the questions. Be sure to answer every question!

1. I like to use the teaching machines. (circle one) Yes No

	Yes	No
High Novelty Effect Group	4	8
Low Novelty Effect Group	4	7

2. If I study mathematics, algebra, or geometry next year, I would: (check one)
   (a) prefer to have teaching machines used for part of the study.
   (b) prefer not to have teaching machines used.
   (c) not care whether teaching machines were used or not.

	a	b	c
High Novelty Effect Group	4	8	0
Low Novelty Effect Group	3	5	3

3. I felt that the teaching machines were used too often during our classes. (circle one) Yes No

	Yes	No
High Novelty Effect Group	5	7
Low Novelty Effect Group	6	5

4. If the teaching machines had not been used this year I believe: (check one)

(a) I would have gotten less out of the course.
(b) I would have gotten more out of the course.
(c) It would have made no difference.

	a	b	c
High Novelty Effect Group	4	6	2
Low Novelty Effect Group	2	6	3

5. As the school year progressed, I became tired of using the machines. (circle one) Yes No

	Yes	No
High Novelty Effect Group	9	3
Low Novelty Effect Group	8	3

6. If I can choose at my new school whether to use teaching machines for part of my study, I will choose to use them. (circle one) Yes No

	Yes	No
High Novelty Effect Group	3	9
Low Novelty Effect Group	5	6

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